mcgehee engineering corp

July 28, 2015

Stephen Miles, P.E.
Alabama Surface Mining Commission
P. O. Box 2390
Jasper, AL 35502-2390

RE: **Black Warrior Minerals, Inc.**
Mine No. 2, P-39__

Dear Mr. Miles:

I hereby certify the enclosed detailed design plans for Sediment Basin 106 for the above referenced Mine are in accordance with the Regulations of the Alabama Surface Mining Commission as adopted by Act 81-435 of December 18, 1981 and as amended to date and that the information used in the enclosed basin design plans is true and correct to the best of my knowledge and belief.

If you have any questions or need additional information, please do not hesitate to contact our office.

Sincerely,

McGehee Engineering Corp.

Bradley K. Simmons, P.E.
Alabama Reg. No. 33277

ALABAMA LICENSED No. 33277 PROFESSIONAL ENGINEER BRADLEY K. SIMMONS

Post Office Box 3431 • 450 19th Street West • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • staff@mcgehee.org

SEDIMENT BASIN CONSTRUCTION SPECIFICATIONS

Sediment basins (temporary or permanent) will be designed and constructed using the following as minimum specifications:

1. EMBANKMENT REQUIREMENTS

A) The minimum width of the top of the embankment will under no circumstance be less than twelve (12) feet.

B) The embankment will have a minimum front and back slope no steeper than the slopes listed on the detailed design sheet.

C) The foundation area of the embankment will be cleared and grubbed of all organic matter with no surface slope steeper than 1 horizontal to 1 vertical. The entire wet area, as measured from the upstream toe of the embankment to the normal pool level, will be cleared of trees and large brush.

D) A core will be constructed in a cutoff trench along the centerline of the embankment. The cutoff trench will be of suitable depth and width to attain relatively impervious material.

E) The embankment construction material will be free of sod, roots, stumps, rocks, etc., which exceed six (6") inches in diameter. The embankment material will be placed in layers of twelve (12") inches or less and compacted to ninety five (95%) percent of the standard proctor density, as set forth in ASTM.

F) The embankment, foundation and abutments will be designed and constructed to be stable under normal construction and operating conditions, with a minimum static safety factor of 1.3 at normal pool level with steady seepage saturation conditions.

G) The actual constructed height of the embankment will be a minimum of five (5%) percent higher than the design height to allow for settling over the life of the embankment.

H) The design embankment height for temporary impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater). The design embankment height for permanent impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater).

I) For embankments constructed as point source discharges, the embankment will be constructed and abutments keyed into undisturbed, virgin, ground if at all possible. In the event that this can not be achieved, additional design and construction specifications will be submitted in the detailed design plans.

J) The embankment and all areas disturbed in the construction of the embankment will be seeded with a mixture of perennial and annual grasses, fertilized and mulched to prevent erosion and ensure restabilization. Hay dams, silt fences, rock check dams, etc. will be installed, where deemed necessary, as additional erosion prevention methods.

K) For basins that will be constructed in spoil material or other pervious previously mined areas, the interior or "wet" area of the basin will be lined with a minimum of one (1') foot of clay material with a permeability no greater than 1×10^{-6} cm/sec up to the emergency spillway elevation. The clay liner material will be placed in lifts no greater than six (6") inches and compacted to ninety-five (95) percent of the standard proctor density.

2. DISCHARGE STRUCTURE REQUIREMENTS

A) The primary spillway will be designed to adequately carry the anticipated peak runoff from a 10 Year - 24 Hour precipitation event. The combination primary and secondary (emergency) spillway system will be designed to safely carry the anticipated peak runoff from a 25 Year - 6 Hour precipitation event. When sediment basins are proposed in the drainage course of a public water supply, the spillway system will be designed and constructed to adequately carry the runoff from a 50 Year - 24 Hour precipitation event.

B) Channel linings, for secondary (emergency) spillways will be a trapezoidal open channel constructed in natural ground and planted with a mixture of both annual and perennial grasses being predominantly fescue and bermuda. In the event that the spillway can not be constructed in natural ground the spillway will be lined with riprap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).

C) When consisting of pipe, the primary spillway will be installed according to Class "C" pipe installation for embankment bedding.

D) Sediment basins with a single spillway system, such as a skimmer board, will be a trapezoidal open channel constructed in consolidated, nonerodible material and lined with rip-rap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).

E) The primary spillway will be designed and constructed with device to eliminate floating solids from leaving the impoundment. This device will consist of a turned down elbow when using pipe or a skimmer system when using an open channel spillway.

F) When necessary, to prevent erosion of the embankment or discharge area, a splash pad of rip-rap, durable rock, sacrete, etc. will be installed at the discharge end of the primary spillway.

G) The combined spillway systems, for sediment basins constructed in series, will be designed to adequately accommodate the entire drainage area.

3. INSPECTION, MAINTENANCE AND CERTIFICATION REQUIREMENTS

A) Inspections will be conducted regularly during construction of the sediment basin by a qualified registered professional engineer or other qualified person under the direction of a professional engineer. Upon completion of construction, the sediment basin will be certified, by a qualified registered professional engineer, to the Regulatory Authority as having been constructed in accordance with the approved detailed design plans.

B) Sediment basins will be inspected semi-monthly for erosion, instability, etc., with maintenance performed as necessary, until the removal of the structure or until a Phase III Bond Release is granted.

C) Sediment basins will be examined quarterly for structural weakness, instability, erosion, slope failure, or other hazardous conditions with maintenance performed as necessary.

D) Formal inspections will be made annually, by a qualified registered professional engineer or other qualified person under the direction of a professional engineer, including any reports or modifications, in accordance with 880-X- 10C- .20[1(j)] of the Alabama Surface Mining Regulations.

E) Retained sediment will be removed from each sediment basin when the accumulated sediment reaches the maximum allowable sediment volume as set forth in the detailed design plans.

4. BASIN REMOVAL REQUIREMENTS

A) Upon completion of mining, reclamation, restabilization and effluent standards being met, each sediment basin not proposed as a permanent water impoundment will be dewatered in a controlled manner by either pumping or siphoning. Upon successful dewatering, a determination will be made as to the retained sediment level in the basin. After determining the retained sediment level, a channel will be cut into the embankment down to the retained sediment level on the side of the embankment deemed most suitable to reach natural ground without encountering prohibiting rock. The embankment material removed from this newly constructed channel will be spread and compacted over the previous impoundment (wet area) area to prevent erosion and ensure restabilization. The newly constructed channel will be of adequate width (minimum 30 feet) and sloped to a grade (approximately 1% to 3%) which will cause all surface drainage to travel across this area in sheet flow, minimizing the possibility of erosion. Also, where necessary, hay dams will be installed in strategic locations across the width of the channel to retain sediment and slow the water velocity to a favorable rate. Upon removal of the embankment section, all disturbed areas will be graded in such a manner to ensure slope stability, successful restabilization and to minimize erosion. All disturbed areas will be seeded with a mixture of annual and perennial grasses, fertilized and mulched. No slope, existing or created in the removal of the sediment basin, will be left on a grade that will slip or slough.

5. PERMANENT WATER IMPOUNDMENT REQUIREMENTS

A) Prior to a request for a Phase II Bond Release, all sediment basins being left as permanent water impoundments will have supplemental data submitted to the Regulatory Authority concerning water quality, water quantity, size, depth, configuration, postmining land use, etc.

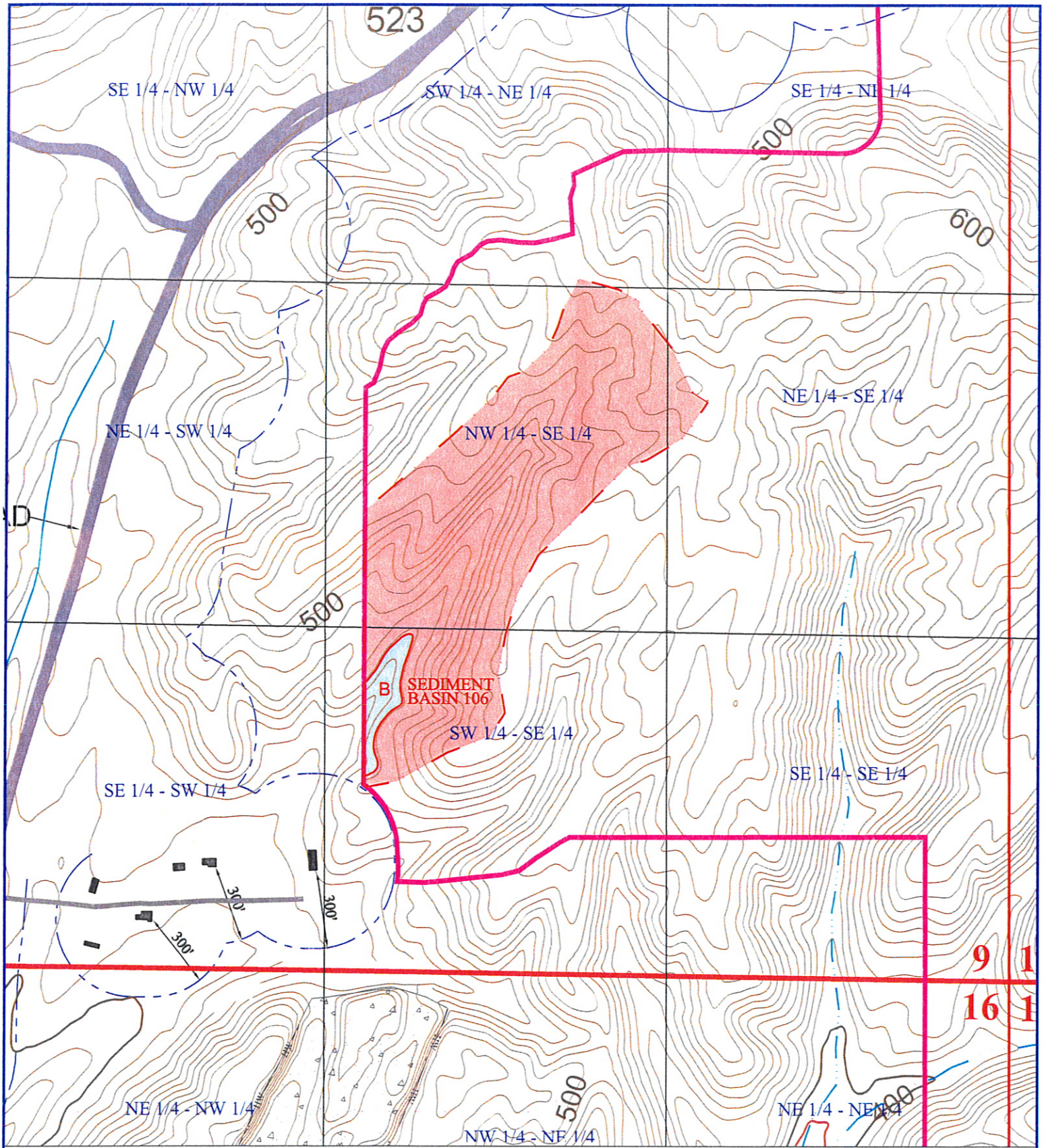
B) Final grading slopes of the entire permanent water impoundment area will not exceed a slope of 2 Horizontal to 1 Vertical to provide for safety and access for future water users.

DETAILED DESIGN PLANS
SEDIMENT BASIN 106

General Notes:

1. Coal may be present in the embankment and pool area. If coal is encountered during embankment construction it will be removed.

2. Portions of the pool area may be mined through and reconstructed after basin is certified. The embankment and spillway system will remain undisturbed after certification.



Contour Interval = 10 ft.

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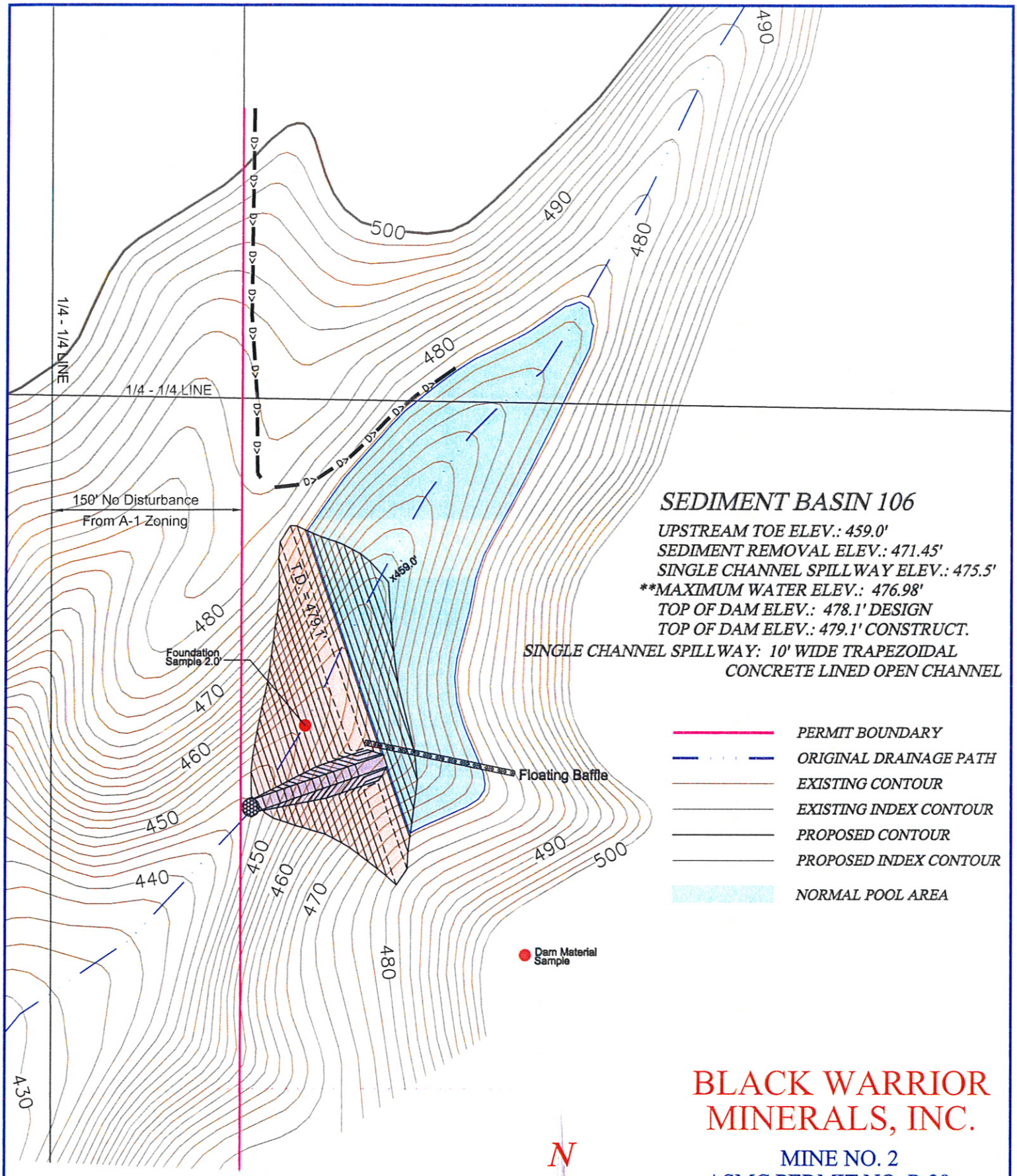
BLACK WARRIOR MINERALS, INC.

MINE NO. 2
ASMC PERMIT NO. P-39__
WATERSHED MAP
SCALE: 1" = 500'

SEDIMENT BASIN 106

PERMIT BOUNDARY
GRADED & BARE, CN 81
B SEDIMENT BASIN, C.N. 100
DRAINAGE DIVIDE
SETBACK / OFFSET



SEDIMENT BASIN 106

UPSTREAM TOE ELEV.: 459.0'
SEDIMENT REMOVAL ELEV.: 471.45'
SINGLE CHANNEL SPILLWAY ELEV.: 475.5'
***MAXIMUM WATER ELEV.: 476.98'*
TOP OF DAM ELEV.: 478.1' DESIGN
TOP OF DAM ELEV.: 479.1' CONSTRUCT.
SINGLE CHANNEL SPILLWAY: 10' WIDE TRAPEZOIDAL CONCRETE LINED OPEN CHANNEL

- *PERMIT BOUNDARY*
- *ORIGINAL DRAINAGE PATH*
- *EXISTING CONTOUR*
- *EXISTING INDEX CONTOUR*
- *PROPOSED CONTOUR*
- *PROPOSED INDEX CONTOUR*
- *NORMAL POOL AREA*

BLACK WARRIOR MINERALS, INC.

MINE NO. 2
ASMC PERMIT NO. P-39__

PLAN VIEW DRAWING
SCALE: 1" = 100'

N
W E
S

Contour Interval = 2 ft.

SEDIMENT BASIN 106

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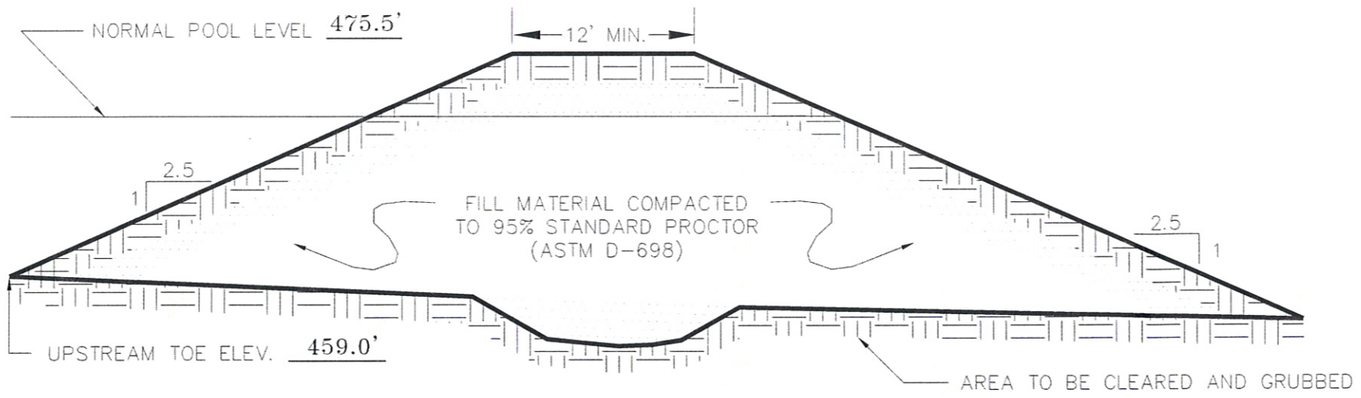
EMBANKMENT CROSS-SECTION



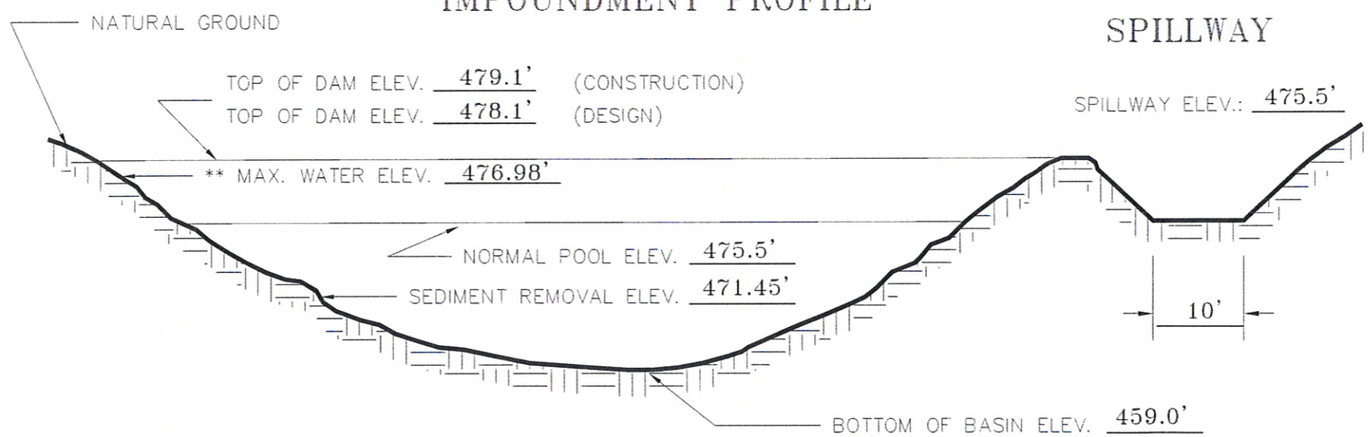
COMPANY: BLACK WARRIOR MINERALS, INC.

MINE NAME: MINE NO. 2

PERMIT #: P-39__

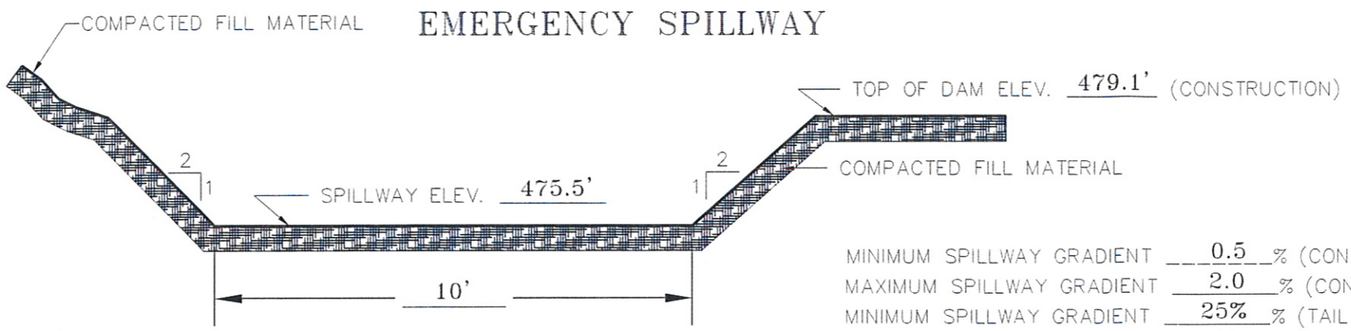
BASIN I.D. #: SEDIMENT BASIN 106

IMPOUNDMENT PROFILE



SPILLWAY

EMERGENCY SPILLWAY



MINIMUM SPILLWAY GRADIENT 0.5 % (CONTROL SECTION)

MAXIMUM SPILLWAY GRADIENT 2.0 % (CONTROL SECTION)

MINIMUM SPILLWAY GRADIENT 25% % (TAIL DITCH SECTION)

MAXIMUM SPILLWAY GRADIENT 40% % (TAIL DITCH SECTION)

SEE SPILLWAY CONTROL SECTION AND TAIL DITCH DESIGN FOR CHANNEL LINING REQUIREMENTS.

KEY BASIN PARAMETERS

DRAINAGE AREA	25.1	ACRES
DISTURBED AREA	24.2	ACRES
SEDIMENT STORAGE	2.42	AC.FT.
DETENTION STORAGE	2.89	AC.FT.
PERMANENT POOL CAPACITY	5.31	AC.FT.
* TOTAL BASIN STORAGE CAPACITY	6.36	AC.FT.
** PEAK INFLOW	73.76	C.F.S.
** PEAK OUTFLOW	59.98	C.F.S.

* 10 YEAR - 24 HOUR PRECIPITATION EVENT.

** 25 YEAR - 6 HOUR PRECIPITATION EVENT.

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Black Warrior Minerals, Inc. - Mine No. 2
Sediment Basin 106

Elevation-Area-Capacity Table

Elevation (ft)	Area (ac)	Capacity (ac-ft)
459.00	0.000	0.000
459.50	0.005	0.001
460.00	0.020	0.007
460.50	0.026	0.018
461.00	0.032	0.032
461.50	0.040	0.050
462.00	0.048	0.072
462.50	0.060	0.099
463.00	0.074	0.133
463.50	0.089	0.173
464.00	0.105	0.222
464.50	0.123	0.279
465.00	0.143	0.345
465.50	0.164	0.422
466.00	0.186	0.509
466.50	0.212	0.609
467.00	0.239	0.721
467.50	0.268	0.848
468.00	0.299	0.990
468.50	0.330	1.147
469.00	0.362	1.320
469.50	0.396	1.509
470.00	0.431	1.716
470.50	0.468	1.940
471.00	0.506	2.184
471.50	0.546	2.447
472.00	0.588	2.730
472.50	0.628	3.034
473.00	0.670	3.359
473.50	0.713	3.704
474.00	0.758	4.072
474.50	0.803	4.463
475.00	0.850	4.876
475.50	0.898	5.313
476.00	0.947	5.774

Elevation (ft)	Area (ac)	Capacity (ac-ft)
476.50	1.003	6.261
477.00	1.061	6.777
477.50	1.121	7.323
478.00	1.182	7.898
478.50	1.232	8.502
479.00	1.283	9.130
479.50	1.345	9.787
480.00	1.408	10.475

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

SPILLWAY CHANNEL SPECIFICATIONS
SEDIMENT BASIN 106

The entire control section and tail ditch section of the emergency spillway will be cut into the compacted fill of the embankment and lined with a minimum of 4 inches of reinforced concrete. All concrete will be reinforced with 10 gauge, 6" x 6" welded wire mesh. Fibermesh may be added to the concrete for additional strength, however, the addition of fibermesh shall not be used in place of the required 6" x 6" welded wire. The control section and tail ditch section of the emergency spillway will extend from the inner face of the embankment, past the centerline of the embankment and be carried out beyond the downstream slope of the embankment.

The gradient of the control section of the emergency spillway will not be less than one half (0.5%) percent and will not exceed two (2.0%) percent. The gradient of the tail ditch section of the emergency spillway will not be less than twenty-five (25%) percent and will not exceed forty (40%) percent.

The concrete liner of the control section of the emergency spillway will be a minimum of 2.5 feet as measured vertically, allowing 1.5 feet for the maximum anticipated flow and 1.0 feet of dry freeboard. The concrete liner of the tail ditch section of the emergency spillway will be a minimum of 1.4 feet as measured vertically, allowing 0.4 feet for the maximum anticipated flow and 1.0 foot of dry freeboard. There will be a transition zone of at least 20 feet in length between the control section and the tail section where the concrete liner will vary from 2.5 feet to 1.4 feet at the end of the transition. The flow line of the spillway will be smoothed at the transition to avoid abrupt changes in the flow line slope.

The minimum depth of the control section is based on the peak stage of 25 year 6 hour rainfall event while the minimum depth of the tail section is based on the SedCad4 utility run with the peak flow 60 CFS on the minimum tail ditch slope of 25%.

Black Warrior Minerals, Inc. - Mine No. 2 Sediment Basin 106 Spillway Tail Section

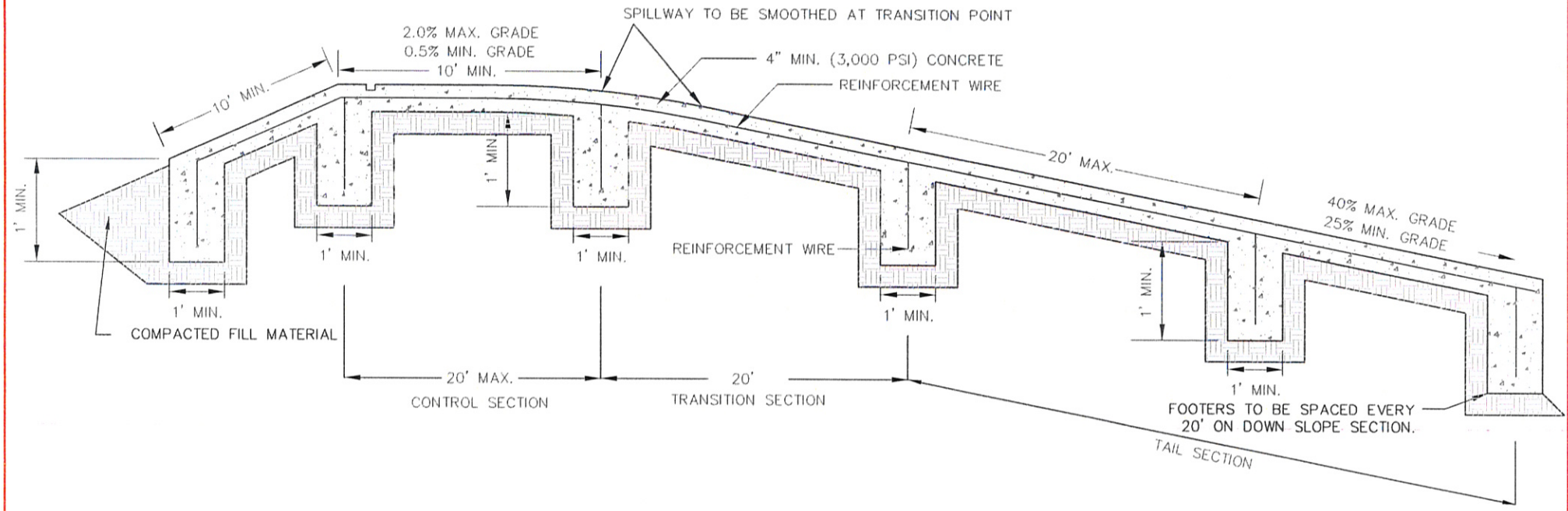
Material: Concrete, Rubble

Trapezoidal Channel

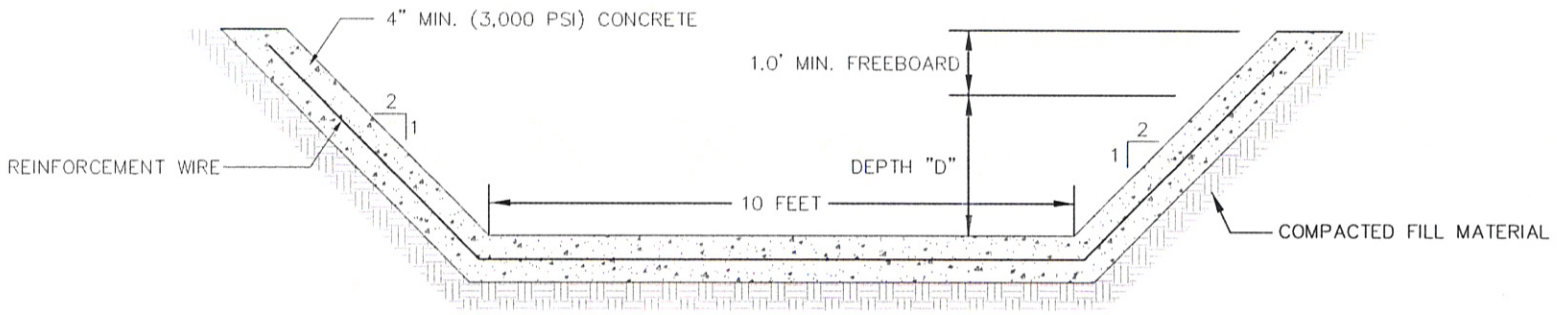
Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	25.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	60.00 cfs	
Depth:	0.35 ft	1.35 ft
Top Width:	11.40 ft	15.40 ft
Velocity:	15.99 fps	
X-Section Area:	3.75 sq ft	
Hydraulic Radius:	0.324 ft	
Froude Number:	4.91	

SEDIMENT BASIN 106 SPILLWAY PROFILE



TYPICAL SPILLWAY CROSS-SECTION



SPILLWAY FLOW DEPTH "D" = 1.5' FEET (CONTROL SECTION)

SPILLWAY FLOW DEPTH "D" = 0.4' FEET (TAIL DITCH SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 2.5' FEET (CONTROL SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 1.4' FEET (TAIL DITCH SECTION)

NOTE: TOTAL SPILLWAY DEPTH IN TRANSITION SECTION VARIES FROM 2.5 FEET TO 1.4 FEET

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BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
10 YEAR - 24 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 106

Black Warrior Minerals
Mine No. 2, P-39

Sediment Basin 106

10 Year - 24 Hour Precipitation Event

Bradley K. Simmons, P.E.

General Information

Storm Information:

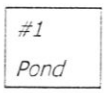
Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	5.900 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	97.000%	98.000%
2.0000	93.000%	97.000%
1.0000	82.000%	85.000%
0.5000	63.000%	70.000%
0.3000	52.000%	46.000%
0.2000	44.000%	37.000%
0.1000	34.000%	26.000%
0.0500	22.000%	15.000%
0.0300	18.000%	12.000%
0.0200	10.000%	9.000%
0.0100	7.000%	6.000%
0.0050	5.000%	4.000%
0.0030	3.000%	2.000%
0.0010	2.000%	1.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 106



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In	25.100	25.100	32.14	8.08	2,651.1	366,807	273.52	161.46
	Out			31.10	8.08	93.4	14,374	0.01	0.01

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	98.000%	100.000%
2.0000	97.000%	100.000%
1.0000	85.000%	100.000%
0.5000	70.000%	100.000%
0.3000	46.000%	100.000%
0.2000	37.000%	100.000%
0.1000	26.000%	100.000%
0.0500	15.000%	100.000%
0.0300	12.000%	100.000%
0.0200	9.000%	100.000%
0.0100	6.000%	100.000%
0.0050	4.000%	100.000%
0.0030	2.000%	56.794%
0.0010	1.000%	28.397%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 106

Pond Inputs:

Initial Pool Elev:	475.50 ft
Initial Pool:	2.89 ac-ft
*Sediment Storage:	2.42 ac-ft
Dead Space:	0.00 %

**Sediment capacity calculated from 0.100 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
475.50	10.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	476.54 ft
H'graph Detention Time:	1.21 hrs
Pond Model:	CSTRS
Dewater Time:	1.15 days
Trap Efficiency:	96.48 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
471.45	0.542	0.000	0.000		Top of Sed. Storage
471.50	0.546	0.028	0.000		
472.00	0.588	0.312	0.000		
472.50	0.628	0.616	0.000		
473.00	0.670	0.940	0.000		
473.50	0.713	1.286	0.000		
474.00	0.758	1.654	0.000		
474.50	0.803	2.044	0.000		
475.00	0.850	2.457	0.000		
475.50	0.898	2.894	0.000		Spillway #1
476.00	0.947	3.355	2.083	16.15	
476.50	1.003	3.843	28.541	11.45	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
476.54	1.009	3.884	31.095	0.05 Peak Stage
477.00	1.061	4.359	60.955	
477.50	1.121	4.904	102.032	
478.00	1.182	5.480	152.957	
478.50	1.237	6.085	214.007	
479.00	1.293	6.717	285.521	
479.50	1.350	7.377	367.859	
480.00	1.408	8.067	461.393	

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
471.45	0.000	0.000
471.50	0.000	0.000
472.00	0.000	0.000
472.50	0.000	0.000
473.00	0.000	0.000
473.50	0.000	0.000
474.00	0.000	0.000
474.50	0.000	0.000
475.00	0.000	0.000
475.50	0.000	0.000
476.00	2.083	2.083
476.50	28.541	28.541
477.00	60.955	60.955
477.50	102.032	102.032
478.00	152.957	152.957
478.50	214.007	214.007
479.00	285.521	285.521
479.50	367.859	367.859
480.00	461.393	461.393

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	24.200	0.000	0.000	0.000	81.000	F	30.75	7.638
	2	0.900	0.000	0.000	0.000	100.000	F	1.39	0.442
	∑	**25.100**						**32.14**	**8.080**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	23.00	0.9000	1.0000	2	2,651.1	380,878	284.02	169.19
	2	0.001	400.00	0.01	0.0001	1.0000	1	0.0	0	0.00	0.00
	∑							**2,651.1**	**366,807**	**273.52**	**161.46**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	10.00	40.00	400.00	0.800	0.138
		6. Grassed waterway	10.00	60.00	600.00	4.740	0.035
		7. Paved area and small upland gullies	5.33	40.00	750.00	4.640	0.044
		8. Large gullies, diversions, and low flowing streams	3.75	60.00	1,600.00	5.800	0.076
#1	**1**	**Time of Concentration:**					**0.000**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#1	**1**	**Muskingum K:**					**0.000**
#1	2	8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#1	**2**	**Muskingum K:**					**0.000**

BLACK WARRIOR MINERALS, INC.
MINE NO. 2, P-39__

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
25 YEAR - 6 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 106

Black Warrior Minerals
Mine No. 2, P-39

Sediment Basin 106

25 Year - 6 Hour Precipitation Event

Bradley K. Simmons, P.E.

General Information

Storm Information:

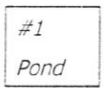
Storm Type:	SCS 6 Hour
Design Storm:	25 yr - 6 hr
Rainfall Depth:	4.900 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	97.000%	98.000%
2.0000	93.000%	97.000%
1.0000	82.000%	85.000%
0.5000	63.000%	70.000%
0.3000	52.000%	46.000%
0.2000	44.000%	37.000%
0.1000	34.000%	26.000%
0.0500	22.000%	15.000%
0.0300	18.000%	12.000%
0.0200	10.000%	9.000%
0.0100	7.000%	6.000%
0.0050	5.000%	4.000%
0.0030	3.000%	2.000%
0.0010	2.000%	1.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 106



Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	In	25.100	25.100	73.76	6.18	3,623.9	542,244	404.34	269.99
	Out			59.98	6.18	156.6	23,895	0.07	0.06

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	98.000%	100.000%
2.0000	97.000%	100.000%
1.0000	85.000%	100.000%
0.5000	70.000%	100.000%
0.3000	46.000%	100.000%
0.2000	37.000%	100.000%
0.1000	26.000%	100.000%
0.0500	15.000%	100.000%
0.0300	12.000%	100.000%
0.0200	9.000%	100.000%
0.0100	6.000%	100.000%
0.0050	4.000%	92.562%
0.0030	2.000%	46.281%
0.0010	1.000%	23.140%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 106

Pond Inputs:

Initial Pool Elev:	475.50 ft
Initial Pool:	2.89 ac-ft
*Sediment Storage:	2.42 ac-ft
Dead Space:	0.00 %

**Sediment capacity calculated from 0.100 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
475.50	10.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	476.98 ft
H'graph Detention Time:	0.68 hrs
Pond Model:	CSTRS
Dewater Time:	0.81 days
Trap Efficiency:	95.68 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
471.45	0.542	0.000	0.000		Top of Sed. Storage
471.50	0.546	0.028	0.000		
472.00	0.588	0.312	0.000		
472.50	0.628	0.616	0.000		
473.00	0.670	0.940	0.000		
473.50	0.713	1.286	0.000		
474.00	0.758	1.654	0.000		
474.50	0.803	2.044	0.000		
475.00	0.850	2.457	0.000		
475.50	0.898	2.894	0.000		Spillway #1
476.00	0.947	3.355	2.083	16.15	
476.50	1.003	3.843	28.541	2.95	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
476.98	1.060	4.343	59.977	0.30	Peak Stage
477.00	1.061	4.359	60.955		
477.50	1.121	4.904	102.032		
478.00	1.182	5.480	152.957		
478.50	1.237	6.085	214.007		
479.00	1.293	6.717	285.521		
479.50	1.350	7.377	367.859		
480.00	1.408	8.067	461.393		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
471.45	0.000	0.000
471.50	0.000	0.000
472.00	0.000	0.000
472.50	0.000	0.000
473.00	0.000	0.000
473.50	0.000	0.000
474.00	0.000	0.000
474.50	0.000	0.000
475.00	0.000	0.000
475.50	0.000	0.000
476.00	2.083	2.083
476.50	28.541	28.541
477.00	60.955	60.955
477.50	102.032	102.032
478.00	152.957	152.957
478.50	214.007	214.007
479.00	285.521	285.521
479.50	367.859	367.859
480.00	461.393	461.393

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	24.200	0.000	0.000	0.000	81.000	F	70.34	5.809
	2	0.900	0.000	0.000	0.000	100.000	F	3.42	0.366
	∑	**25.100**						**73.76**	**6.175**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	23.00	0.9000	1.0000	2	3,623.9	562,671	419.58	282.86
	2	0.001	400.00	0.01	0.0001	1.0000	1	0.0	0	0.00	0.00
	∑							**3,623.9**	**542,244**	**404.34**	**269.99**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	10.00	40.00	400.00	0.800	0.138
		6. Grassed waterway	10.00	60.00	600.00	4.740	0.035
		7. Paved area and small upland gullies	5.33	40.00	750.00	4.640	0.044
		8. Large gullies, diversions, and low flowing streams	3.75	60.00	1,600.00	5.800	0.076
#1	**1**	**Time of Concentration:**					**0.000**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#1	**1**	**Muskingum K:**					**0.000**
#1	2	8. Large gullies, diversions, and low flowing streams	5.00	20.00	400.00	6.700	0.016
#1	**2**	**Muskingum K:**					**0.000**

STABILITY ANALYSIS

STABILITY ANALYSIS PROCEDURE

The computer program used to analyze the slope stability was the REAME Slope Stability Program as developed by Dr. Yang H. Huang, P.E. of the University of Kentucky.

The soil types of the foundation material beneath the proposed embankment structures of Sediment Basin 106 was sampled, analyzed and classified by personnel of McGehee Engineering Corp. The depths to the stiff base of Sediment Basin 106 (2.0') was measured by personnel of McGehee Engineering Corp.

The soil type to be used in the construction of the proposed embankment structure of Sediment Basin 106 was sampled, analyzed and classified by personnel of McGehee Engineering Corp. This sample of material was taken from adjacent ridge top material between the two embankments that is representative of the material to be used as dam material for both embankments.

SOIL PROPERTIES

USAGE	TYPE	COHESION (psf)	INTERNAL ANGLE OF FRICTION	EFFECTIVE DENSITY (pcf)
106 FOUND.	SC	100.00	27.92	133.52
106 DAM	SM	270.00	33.02	132.14

ANALYSIS RESULTS

BASIN	STATIC SAFETY FACTOR
106	1.663

mcgehee engineering corp

SIEVE ANALYSIS

(ASTM C136-96a)

Company Name: Black Warrior Minerals
Location: Mine #1
Sample I.D.: Basin 106
Description: Foundation

Sample Date: 1/30/14
Analyzed By: C. Smith
Date Analyzed: 2/12/14
Requested By: S. Hendon

Weight of Oven Dry Sample (W): **1002.0 Grams**

Sieve No.	Sieve + Sample Weight	Sieve Weight	Sample Weight Retained	Percent of Total Retained	Cumulative Weight Percent	Percent Retained	Percent Finer
1"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3/4"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1/2"	538.0	538.0	0.0	0.0	0.0	0.0	100.0
4	618.0	513.0	105.0	10.5	10.5	10.5	89.5
10	643.0	462.0	181.0	18.1	28.5	28.5	71.5
40	697.0	383.0	314.0	31.3	59.9	59.9	40.1
200	420.0	333.0	87.0	8.7	68.6	68.6	31.4
Pan	695.0	380.0	315.0	31.4	100.0	100.0	0.0
		Total Weight (W1):	1002.0				

SOIL CLASSIFICATION

Unified System (ASTM D-2487)

Liquid Limit: 31.1
Plastic Limit: 22.4
Plasticity Index: 8.7

Soil Classification: SC

Coarse Grained
Clayey Sand

Effective Cohesion: 0.6940 psi
Total Cohesion: 8.610 psi
Permeability: 0.50 ft/yr
Maximum Dry Density: 116.0 pcf
Optimum Moisture: 15.1 %
Effective Cohesion: 99.9 psf
Angle of Internal Friction: 27.92 degrees
Mass Unit Weight: 133.52 pcf

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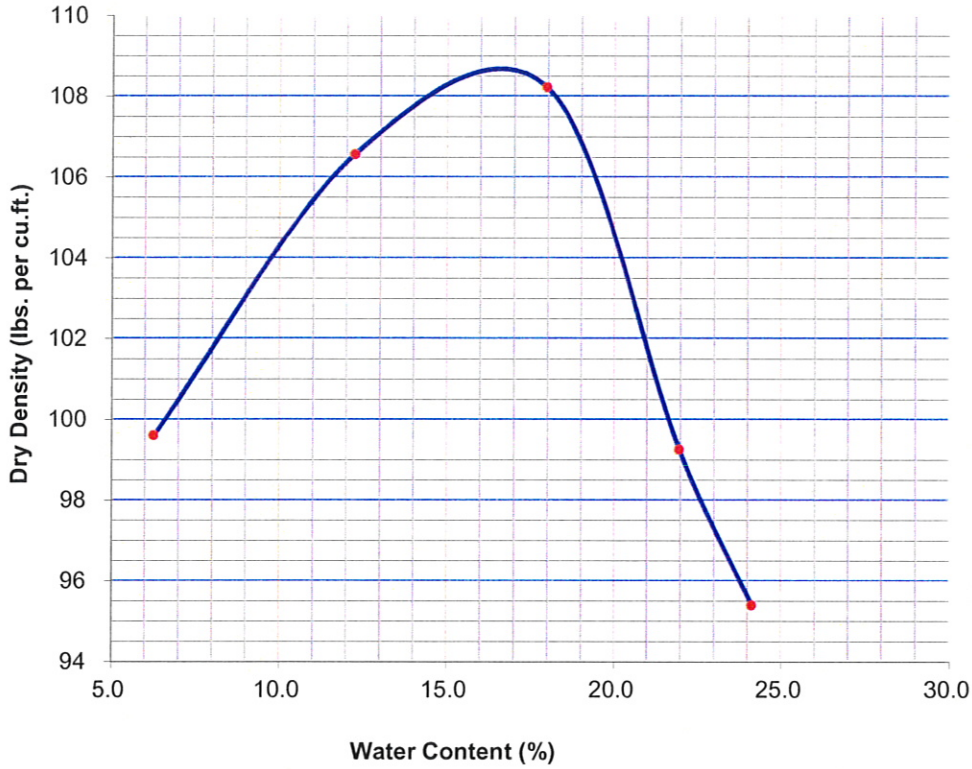
mcgehee engineering corp

Black Warrior Minerals
Mine #1, Basins 106, Dam Material
Moisture Density Relationship
(Proctor Method)



ASTM D-698 Method A	Water Content %	Specific Gravity	%> No. 4	%< No. 200	LL %	PL %	PI %
			12.9	23.2	22.9	20.8	2.1

Sample Description, Classification and Location	Sample No.: Basins 106 Dam Material
Coarse Grained Silty Sand	Optimum Moisture Content= 16.9 Maximum Dry Density = 109.3

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STANDARD PROCTOR COMPACTION TEST (ASTM D-698)

Company Name: Black Warrior Minerals
Location: Mine #1
Sample I.D.: Basins 106
Description: Dam Material

Sampled By: B. Justice
Sample Date: 1/30/14
Analyzed By: C. Smith
Date Analyzed: 2/12/14
Requested By: S. Hendon

Weight of Mold (W1): 4,250 Grams

Test No.	Wt. of Mold & Wet Soil (w2) grams	Wt. of wet Soil (w2-w1) grams	Wet Unit Wt. (w2-w1)/c lb/cu-ft	Moisture Content (w) %	Dry Unit Weight lb/cu-ft
1	5,850	1,600	105.8	6.3	99.6
2	6,058	1,808	119.6	12.2	106.6
3	6,180	1,930	127.6	18.0	108.2
4	6,080	1,830	121.0	22.0	99.2
5	6,040	1,790	118.4	24.1	95.4
6					
7					

Constant C = 15.12 (conversion factor)

MOISTURE CONTENT DETERMINATION

Test No.	1	2	3	4	5	6	7
Can No.	1	2	3	4	6		
Wt. of Can, a, (g)	20.47	21.41	20.57	20.45	20.52		
Wt. of Can + Wet Soil, b, (g)	96.01	86.31	90.01	100.37	94.40		
Wt. of Can + Dry Soil, c, (g)	91.56	79.24	79.44	85.98	80.04		
* Moisture Content, w, (%)	6.26	12.23	17.95	21.96	24.13		

* Moisture Content, w = (b - c)/(c - a) x 100

REAME
(Rotational Equilibrium Analysis of Multilayered Embankments)
Black Warrior Minerals, Inc.
Mine No. 1, P-3950
Sediment Basin 106 -Static Case

Number of boundary lines= 4
Number of points on boundary lines are: 2 2 3 7

On boundary line no. 1 Point no. and coordinates are:
1 .000 31.500 2 500.000 .000

On boundary line no. 2 Point no. and coordinates are:
1 200.000 20.900 2 333.531 12.488

On boundary line no. 3 Point no. and coordinates are:
1 .000 33.500 2 200.000 20.900 3 241.250 37.400

On boundary line no. 4 Point no. and coordinates are:
1 .000 37.400 2 241.250 37.400 3 250.250 41.000 4 262.250 41.000 5 313.601 20.460
6 333.531 12.488 7 500.000 2.000

Line no. and slope of each segment are:
1 -.063
2 -.063
3 -.063 .400
4 .000 .400 .000 -.400 -.400 -.063

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	100.000	27.920	133.520
2	270.000	33.020	132.140
3	.000	.000	62.400

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 37.400 2 241.250 37.400 3 271.238 30.923 4 313.601 20.460 5 333.531 12.488
6 500.000 2.000

point1=(263.000, 62.000) point2=(263.000, 42.000) point3=(335.000, 42.000) NJ= 2 NI= 2
Automatic search will follow after grid with XINC= 10.000 and YINC= 10.000

At point (263.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
46.976 7.638 41.783 8.914 36.591 9.177 31.398 9.598 26.206 10.756
Lowest factor of safety= 7.638 and occurs at radius = 46.976

At point (263.000, 52.000) under seepage 1,the radius and the corresponding factor of safety are:
36.996 7.725 31.802 8.786 26.608 8.613 21.414 8.608 16.220 9.936
24.876 8.506 23.145 8.535 19.682 8.744 17.951 9.048
Lowest factor of safety= 7.725 and occurs at radius = 36.996

At point (263.000, 42.000) under seepage 1,the radius and the corresponding factor of safety are:
27.015 8.420 21.854 9.113 16.692 8.929 11.530 9.866 6.369 11.825
20.133 9.004 18.413 8.958 14.972 9.152 13.251 9.521
Lowest factor of safety= 8.420 and occurs at radius = 27.015

At point (299.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
49.239 1.870 46.021 2.274 42.802 2.526 39.584 3.071 36.365 4.503
Lowest factor of safety= 1.870 and occurs at radius = 49.239

At point (299.000, 52.000) under seepage 1,the radius and the corresponding factor of safety are:
39.259 1.950 36.180 2.397 33.100 2.663 30.021 3.215 26.941 4.731
Lowest factor of safety= 1.950 and occurs at radius = 39.259

At point (299.000, 42.000) under seepage 1,the radius and the corresponding factor of safety are:
29.279 2.166 26.339 2.687 23.398 2.942 20.458 3.504 17.517 5.097
Lowest factor of safety= 2.166 and occurs at radius = 29.279

At point (335.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
51.503 2.325 50.506 2.712 49.508 3.779 48.511 5.132 47.514 9.213
Lowest factor of safety= 2.325 and occurs at radius = 51.503

At point (335.000, 52.000) under seepage 1,the radius and the corresponding factor of safety are:
41.523 2.514 40.664 2.929 39.806 3.813 38.948 5.760 38.090 10.496
Lowest factor of safety= 2.514 and occurs at radius = 41.523

At point (335.000, 42.000) under seepage 1,the radius and the corresponding factor of safety are:
31.542 2.800 30.823 3.273 30.104 4.205 29.385 6.712 28.666 12.406
Lowest factor of safety= 2.800 and occurs at radius = 31.542

For piezometric line No. 1 At point (299.000, 62.000) ,RADIUS 49.239
the minimum factor of safety is 1.870

At point (299.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
49.239 1.870 46.021 2.274 42.802 2.526 39.584 3.071 36.365 4.503
Lowest factor of safety= 1.870 and occurs at radius = 49.239

At point (309.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
49.868 1.751 47.267 2.246 44.665 2.552 42.063 3.175 39.462 5.029
Lowest factor of safety= 1.751 and occurs at radius = 49.868

At point (319.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
50.497 1.719 48.512 2.342 46.528 2.709 44.543 3.452 42.559 5.721
Lowest factor of safety= 1.719 and occurs at radius = 50.497

At point (329.000, 62.000) under seepage 1,the radius and the corresponding factor of safety are:
51.126 1.905 49.758 2.223 48.391 3.153 47.023 4.168 45.656 7.204
Lowest factor of safety= 1.905 and occurs at radius = 51.126

At point (319.000, 72.000) under seepage 1,the radius and the corresponding factor of safety are:
60.477 1.692 58.353 2.272 56.230 2.626 54.106 3.351 51.983 5.530
Lowest factor of safety= 1.692 and occurs at radius = 60.477

At point (319.000, 82.000) under seepage 1,the radius and the corresponding factor of safety are:
70.457 1.673 68.195 2.219 65.932 2.560 63.669 3.268 61.406 5.361
Lowest factor of safety= 1.673 and occurs at radius = 70.457

At point (319.000, 92.000) under seepage 1,the radius and the corresponding factor of safety are:
80.438 1.663 78.036 2.171 75.634 2.505 73.232 3.194 70.830 5.184
Lowest factor of safety= 1.663 and occurs at radius = 80.438

At point (319.000, 102.000) under seepage 1,the radius and the corresponding factor of safety are:
90.418 1.680 87.877 2.153 85.336 2.452 82.795 3.132 80.254 4.987
Lowest factor of safety= 1.680 and occurs at radius = 90.418

At point (329.000, 92.000) under seepage 1,the radius and the corresponding factor of safety are:
81.066 1.815 79.281 2.201 77.497 2.792 75.712 3.641 73.927 6.151
Lowest factor of safety= 1.815 and occurs at radius = 81.066

At point (309.000, 92.000) under seepage 1,the radius and the corresponding factor of safety are:
79.809 1.753 76.790 2.174 73.771 2.416 70.752 2.967 67.733 4.511
Lowest factor of safety= 1.753 and occurs at radius = 79.809

At point (321.500, 92.000) under seepage 1,the radius and the corresponding factor of safety are:
80.595 1.671 78.347 2.206 76.100 2.559 73.852 3.277 71.605 5.384
Lowest factor of safety= 1.671 and occurs at radius = 80.595

At point (316.500, 92.000) under seepage 1,the radius and the corresponding factor of safety are:
80.280 1.669 77.724 2.148 75.168 2.456 72.612 3.124 70.056 4.988
Lowest factor of safety= 1.669 and occurs at radius = 80.280

At point (319.000, 94.500) under seepage 1,the radius and the corresponding factor of safety are:
82.933 1.664 80.496 2.163 78.059 2.493 75.623 3.177 73.186 5.135
Lowest factor of safety= 1.664 and occurs at radius = 82.933

At point (319.000, 89.500) under seepage 1,the radius and the corresponding factor of safety are:
77.942 1.663 75.575 2.181 73.208 2.518 70.841 3.212 68.474 5.228
Lowest factor of safety= 1.663 and occurs at radius = 77.942

At point (319.000, 87.000) under seepage 1,the radius and the corresponding factor of safety are:
75.447 1.664 73.115 2.195 70.783 2.531 68.451 3.230 66.118 5.272
Lowest factor of safety= 1.664 and occurs at radius = 75.447

At point (321.500, 89.500) under seepage 1,the radius and the corresponding factor of safety are:
78.100 1.674 75.887 2.219 73.674 2.573 71.461 3.296 69.249 5.431
Lowest factor of safety= 1.674 and occurs at radius = 78.100

At point (316.500, 89.500) under seepage 1,the radius and the corresponding factor of safety are:
77.785 1.667 75.264 2.154 72.743 2.473 70.221 3.139 67.700 5.036
Lowest factor of safety= 1.667 and occurs at radius = 77.785

For piezometric line No. 1
At point (319.000, 89.500) ,RADIUS 77.942
the minimum factor of safety is 1.663

Cross section in distorted scale. Numerals indicate boundary line no. If there area more than 10 bound. lines, alphabets will then be used. P indicates Piezometric line. If a portion of Piezometric line coincides with the ground or another boundary line, only the ground or boundary line will be shown. X indicates intersection of two boundary lines. * indicates failure surface.
The minimum factor of safety is 1.663